

## **The WFIRST Mission**

The primary purposes of the Wide Field Infrared Survey Telescope (WFIRST) mission are to determine the nature of the dark energy that appears to be driving the current accelerating expansion of the universe, to perform statistical census of planetary systems through a micro-lensing sky survey, to perform a general survey of the NIR sky, and to provide the astrophysics/astronomical community with a space telescope for stable wide-field observations. WFIRST will perform Hubble-quality imaging over thousands of square degrees for 5 years (10 year goal) in a geosynchronous orbit. WFIRST will settle essential questions in both exoplanet and dark energy research and will advance topics ranging from galaxy evolution to the study of objects within the Galaxy and within the Solar System. It is the top-ranked large space mission in the New Worlds, New Horizon Decadal Survey of Astronomy and Astrophysics.

The WFIRST will perform wide-field imaging and slitless spectroscopic surveys of the near infrared (NIR) sky for the astrophysics community by integrating the existing, repurposed 2.4m Astrophysics Focused Telescope Asset (AFTA) with a Wide Field Imager (WFI) consisting of 18 H4RG HgCdTe detectors, a multi-filter NIR spectrometer, and a baseline exoplanet coronagraph for direct imaging of exoplanets and debris disks.

Additional information regarding the WFIRST Mission can be found at <http://wfirst.gsfc.nasa.gov/>. A write-up on the instrument can be found in the SPIE digital library: D. A. Content, N. V. Armani, C. L. Baker, C. E. Jackson, Duncan M. Kahle, et al., "Wide field instrument preliminary design for the wide field infrared survey telescope," SPIE 8860 (2013) doi: 10.1117/12.2025496.

## **Information Sought**

NASA is in the process of assessing industry capability for operationally low temperature (170K), lightweight mirrors and mounted mirror assemblies for the WFIRST Wide Field Imager (WFI). The purpose of this Request for Information (RFI) is to:

- Identify potential industry interest in providing Engineering Development Unit (EDU) and Flight Model (FM) low temperature M3 mirror and/or M3 mounted mirror assembly for the WFIRST WFI. This information will be used for internal requirement trade studies, information and procurement planning purposes, to allow industry the opportunity to verify reasonableness and feasibility of WFIRST M3 requirements, and to promote competition
- Assess current industry capabilities to design, develop, qualify and deliver a WFIRST low temperature lightweight M3 mirror or M3 mounted mirror assembly based on the preliminary requirements provided in Table 1
- Understand implied cost and schedule drivers and candidate cost/schedule/performance trades to be considered in procuring and M3 mirror or M3 mounted mirror assembly
- Ensure a complete M3 mirror/mounted mirror assembly trade space is defined for material selection, mount configuration, coating selection, mirror design/fabrication/test, and any other new/novel approaches that might add scientific and/or economic value to the WFIRST mission

- Obtain cost and schedule rough order magnitude (ROM) estimates from potential mirror and mirror assembly providers. These data are to be used solely for internal budgetary planning purposes and will not be used to pre-select or rank potential suppliers for any future procurement

NASA is particularly concerned about the control of low temperature mirror mounting strain, gravity release error (factory to orbit), and mirror substrate CTE non-uniformity.

### **WFIRST M3 and M3 Assembly Description**

In order to implement the WFIRST mission reusing the existing 2.4m telescope, we plan to include a near-cryogenic instrument mirror denoted as M3. NASA is considering two procurement approaches for M3. The first option is to procure a flight qualified lightweight low temperature M3 mirror verified to NASA specifications. The second option being considered is to procure a flight qualified M3 mounted mirror assembly consisting of an M3 mirror mounted to a lightweight backplane for subsequent integration to the WFIRST WFI. Preliminary requirements provided in Table 1 encompass both of these procurement options.

### **Preliminary Requirements**

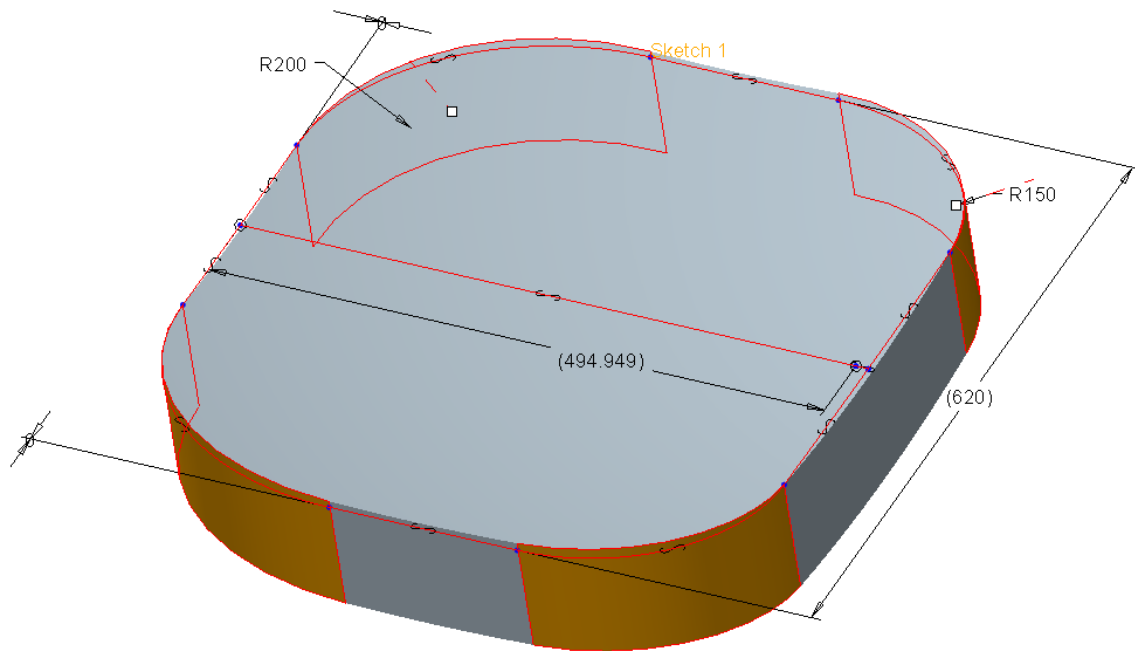
Internal assessments of WFIRST Mission Requirements, constraints, and packaging limitations have yielded the following preliminary requirements for the WFIRST TM/TMA:

**Table 1 - Preliminary M3 Requirements**

Ref	Parameter	Value	Notes/Assumptions	Questions to be Addressed
1	M3 Mounted Mirror Assembly Volume Allocation	See attachment "AFTA_M3_ULE_v4-2-5_ENV_v140912.pdf"	Drawing dimensions in metric units with inches in parentheses	
2	M3 Radius of Curvature (RoC)	1729.732 $\pm$ 0.050 mm (TBR)		<b>Q2.1</b> How well can RoC be controlled in the manufacturing process? <b>Q2.2</b> How well can RoC be measured during testing?
3	M3 Conic Constant (Kc)	-0.566601 $\pm$ TBD	The vertex position is centered with respect to the M3 mirror volume shown in Figure 1  Assume a right-handed coordinate system with the z-axis is normal to the optical surface of the mirror	<b>Q3.1</b> How well can Kc be controlled in the manufacturing process? <b>Q3.2</b> How well can Kc be measured during testing? <b>Q3.3</b> How well can the positions of the M3 vertex and its fiducial be controlled?
4	M3 Form Factor	620 x 495 x 70 mm TBR $\pm$ 0.050mm TBR (see Figure 1)		<b>Q4.1</b> What are recommended edge chamfer dimensions?
5	On-orbit Operating Temperature	170K $\pm$ 1K		
6	M3 Mounted	$\leq$ 18.3 nm	On-orbit (0 gravity)	

	Mirror Assembly RMS Surface Figure Error		1.0 micron wavelength; Temp = 170K; Through Thickness Gradient = 0.5K (TBR); WC Cross Face Gradient = 0.5K (TBR)	
7	M3 Mirror RMS Surface Roughness	$\leq 3$ nm		
8	M3 Coating	Vacuum deposited Au (TBR)		<b>Q8.1</b> What coating trades are applicable to your capability?
9	M3 Mirror Mass	$< 9.1$ Kg (TBR)	The mass allocation for M3 mirror will depend in part on industry capability versus cost.	<b>Q9.1</b> What are your mirror areal density relationships to ROM cost? <b>Q9.2</b> What is your approach to managing M3 mass margin?
10	M3 Mounted Mirror Assembly Mass	$< 11.8$ kg (TBR)	The mass allocation for the M3 mounted mirror assembly will depend in part on industry capability versus cost.	<b>Q10.1</b> What are your mounted mirror mass relationships to ROM cost? <b>Q10.2</b> What is your approach to managing M3 Assembly mass margin?
11	Fiducials	A fiducial at, or referenced to, the M3 vertex (TBR)	Required for integration of the M3 into the WFI.	<b>Q11.1</b> What are your recommended methods for fiducializing M3?
12	First Mode	$\geq 50$ Hz		
13	Design Margins and Factors of Safety	In accordance with NASA-STD-5001 and GSFC-STD-1000F		
14	Schedule	Mirror Only: $\leq 12$ months ARO (TBR) Mounted Mirror Assembly: $\leq 18$ months ARO (TBR)	Notional	<b>Q12.1</b> What are your schedule durations, constraints and/or exceptions assuming delivery of an EDU prior to ATP for a flight article?
15	Analysis, Verification and Test	Mirror and Mounted Mirror Assembly: Optical performance fully verified; substrate flight qualified Mounted Mirror Assembly: Optical performance fully verified and hardware fully qualified	Factors of Safety in accordance with NASA-STD-5001 Structural Loads Qualification in accordance with GFSC-STD-7000A paragraph 2.4.1 Workmanship Testing in accordance with GSFC-STD-7000A paragraph 2.4.2 Thermal Design Verification and Test Margins in accordance with GSFC-STD-7000A paragraph 2.6.2 & 2.6.3	<b>Q13.1</b> What is your candidate compliance approach for demonstrating M3 mirror and/or M3 mounted mirror assembly requirements have been achieved?

NASA is interested in understanding industries approach to achieve the above requirements, including but not limited to material selection, mirror blank design approach, strain control/mounting approach, mirror manufacturing accuracy and precision, and metrology approach.



**Figure 1 - WFIRST Preliminary M3 Form Factor (dimensions in mm)**

### **Response Instructions**

To consolidate our planning, responses from industry are requested by Friday, October 24<sup>th</sup>, 2014 in the form of written and illustrated concepts, ROM estimates for development costs and schedule, assumptions used for cost and schedule ROM estimates including interface and design assumptions, and descriptions of capabilities as appropriate to the preliminary requirements outlined in Table 1. Responses can be submitted via email. The subject line of the submission should be "RFI for WFIRST M3," and attachments should be in Microsoft WORD, POWERPOINT, or PDF format. The email text must give a point-of-contact and provide his/her name, address, telephone/fax numbers, and email address. The information is requested for planning purposes only, subject to FAR Clause 52.215-3, entitled "Solicitation for Information for Planning Purposes."

It is not NASA's intent to publicly disclose vendor proprietary information obtained during this solicitation. To the full extent that it is protected pursuant to the Freedom of Information Act and other laws and regulations, information identified by a respondent as "Proprietary or Confidential" will be kept confidential.

It is emphasized that this RFI is for planning and information purposes only. This RFI is NOT to be construed as a commitment by the Government to enter into a contractual agreement, nor will the Government pay for information solicited.

No solicitation exists; therefore, do not request a copy of the solicitation. If a solicitation is released, it will be synopsisized in FedBizOpps and on the NASA Acquisition Internet Service. It is the potential offeror's responsibility to monitor these sites for the release of any solicitation or synopsis.

Technical questions should be directed to: Jeff Stewart at (301) 286-3218 or [Jeffrey.W.Stewart@nasa.gov](mailto:Jeffrey.W.Stewart@nasa.gov). Procurement related questions should be directed to: Julie Janus at (301) 286-4931 or [Julie.A.Janus@nasa.gov](mailto:Julie.A.Janus@nasa.gov).

Interested offerors shall address the requirements of this RFI in written format as described in the previous paragraphs by electronic mail to: Jeff Stewart at [Jeffrey.W.Stewart@nasa.gov](mailto:Jeffrey.W.Stewart@nasa.gov), no later than 5:00 PM EST on Friday, October 24th, 2014.

An ombudsman has been appointed -- See NASA Specific Note "B".

The solicitation and any documents related to this procurement will be available over the Internet. These documents will be in Microsoft Office format and will reside on a World Wide Web (WWW) server, which may be accessed using a WWW browser application. The Internet site, or URL, for the NASA/GSFC Business Opportunities home page is <http://prod.nais.nasa.gov/cgi-bin/eps/bizops.cgi?gr=C&pin=51>. It is the offeror's responsibility to monitor the Internet site for the release of the solicitation and amendments (if any). Potential offerors will be responsible for downloading their own copy of the solicitation and amendments, if any.

**Attachment:** AFTA\_M3\_ULE\_v4-2-5\_ENV\_v140912.pdf

### **Acronym List**

ARO: After Receipt of Order  
ATP: Authorization to Proceed  
CTE: Coefficient of Thermal Expansion  
EDU: Engineering Development Unit  
NIR: Near Infrared  
RFI: Request for Information  
RMS: Root Mean Square  
ROM: Rough Order Magnitude  
TBD: To Be Determined  
TBR: To Be Reviewed  
WFI: Wide Field Instrument  
WFIRST: Wide Field Infrared Survey Telescope